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METHOD AND DEVICE FOR PENETRATING FILM-TYPE SUBSTRATES

The invention relates to a method and device for inflating, separating and/or filling tightly adjacent foil layers without having to use additional auxiliary means, such as valves, devices, funnels or the like.

The invention relates to in particular to a method and a device for penetrating foil-like or film-type substrates being arranged air-proofed or tightly one above the other.

To fill tightly adjacent foils or bags, devices are usually employed, in which the individual layers are either mechanically separated (torn apart), wherein further cannules or the like for filling are inserted in the separated layers only afterwards, or cannules, nozzles or the like are tried to be inserted or pricked between the foil layers by complex and sensitive manual operations.

Another method frequently applied would consist in inserting valves, filling openings or spacers into the foils to be confectioned on appropriate sites in previous manufacturing steps in order to subsequently enable suitable cannules or nozzles to be connected to the thus prepared sites for the filling procedure. Yet, accordingly high expenditures in terms of material, time and costs would have to be taken into account in all those processes and automation processes would be accordingly more complex and demanding. Likewise, foils upgraded by additional functions (e.g., valves or filling openings) in most cases are comprised of thus formed composite materials and hence require cumbersome operating techniques for the appropriate disposal of such materials.

The invention aims at providing a method and device for filling foil bags, and separating tightly adjacent foil layers, by a method and device simple to handle, which is not very demanding on the foil either.

For solving this object there is provided a method for penetrating film-type substrates being arranged air-proofed or tightly one above the other, wherein only a desired number of foil layers is pierced by the defined rotation of a cylindrical hollow body through control of the number of rotations and extent of the torque of at least one cutting surface of the helically terminating portion of the cylindrical hollow body.

According to the invention the foils to be separated, or the bag to be filled, are guided to the end comprising the cutting surfaces, of the unilaterally helically designed, cylindrical hollow body. As opposed to conventional methods including special filling openings, no exact positioning on the workpiece foil is required here. Rather are the foils applied at the cutting surfaces of the helically designed, cylindrical hollow body, and fixed in their positions, either by sucking in through the funnel surrounding the cylindrical hollow body or by pressing with a cushioned surface according to preferred embodiments of the invention. After this, the cylindrical hollow body is set in a controlled and defined rotary movement, thus causing the cutting surface constituting the end of the helically designed, cylindrical hollow body to initially punctually roughen the foil by friction in order to be able to subsequently seize the foil by the tip of the cutting surface, due to the provided roughness of the foil surface, and penetrate the foil at a further rotary movement. In doing so, the foil is circularly opened by the cutting surface extending perpendicular to the first-mentioned cutting surface and, due to the threaded structure of the cylindrical hollow body, the tip is further

rotated between the foil layers and/or due to said threaded structure, is lifted along the lead of the threaded structure. When parametrizing (number of rotations, speed and torque) the drive of the cylindrical hollow body, both material strengths, material properties and the number of foil layers to be separated can be taken into account.

For allowing an easy filling there is furthermore proposed according to a preferred embodiment that a gaseous or liquid medium is introduced between the foil layers and through the specially inserted cylindrical hollow body.

For solving the above object there is also provided a device for penetrating film-type substrates being arranged air-proofed or tightly one above the other, comprising a unilaterally helically designed, cylindrical hollow body, wherein at least one cutting surface of the helically terminating portion of the cylindrical hollow body is designed to gradually pierce a foil or, respectively, by rotation on the same, so as to prevent any penetration into the consecutive foil layer at a defined stop of the rotary movement.

According to the invention a rotationally mounted and accordingly driven tubular hollow cylinder is used, which is helically designed on one side. The runout end of this helical hollow cylinder is provided for example with two cutting surfaces arranged perpendicular to each other and converging into a tip by extending towards each other and following the circumference of the hollow cylinder. The functions of these cutting surfaces are divided in a manner that the cutting surface crucial for the beginning of the process, which is arranged largely perpendicular to the bore axis of the hollow cylinder, is responsible for the roughening and incipient cut of the material to be penetrated. The cutting edge of this cutting

surface is thus ground to terminate towards the end only on one side, too. The second cutting surface, which extends perpendicularly to the former (hence parallel to the bore axis of the hollow cylinder) is subsequently responsible for making a cut that extends circularly in correspondence with the circumference of the hollow cylinder. The converging tip formed by the two cutting surfaces, in turn, is designed such that the foil surface roughened by the cutting surface extending perpendicular to the bore axis can be seized, thus enabling the tip to penetrate the foil material at a very flat angle. An angular deviation of the first cutting surface, based on the perpendicular line relative to the bore axis of the hollow cylinder, is decisive for the roughening or penetration behaviour. The more obtuse said angle, based on the perpendicular line relative to the bore axis, the more aggressive the penetration of the foils by the helically designed hollow cylinder, thus involving the risk of penetrating or hurting also the second foil layer arranged immediately below. Such constellations will, therefore, be used only with resistant and thicker foil materials.

An easy adaptation to different materials and material thicknesses is feasible by the angle of inclination of the cutting surface according to a preferred embodiment of the inventive device.

For an easy determination of the distance of individual foil layers relative to each other it is preferably proposed that such distance is determined during separation by the lead of the thread constituting the helical configuration.

In many cases the degree of adherence of an individual foil layer has to be taken into account. In this context it is furthermore preferably proposed that the degree of adherence of

the individual foil layers to the cylindrical hollow body is determined by determining the dimension of the thread constituting the helical configuration.

For allowing a secure positioning of the inventive device when penetrating at least one foil layer it is furthermore preferably proposed that the hollow body is fixedly surrounded by a funnel-shaped part through which the surrounding atmosphere can be sucked in a manner that the foil layers applied on the helically designed, cylindrical hollow body are sucked in by vacuum and thereby placed into a defined and immovable position relative to the cutting surfaces forming the end of the helically designed, cylindrical hollow body.

For enhancing the exact positioning as well as avoiding that an excessive stress is applied in particular on any foil being opposite to the foil to be pricked or penetrated there is furthermore preferably proposed that the inventive device is connectable with a cushioning part located opposite the cutting surfaces forming the end of the helically designed, cylindrical hollow body, in a manner that said cushioning part places the foil layers in a defined and immovable position relative to the cutting surfaces forming the end of the helically designed, cylindrical hollow body.

Depending on the application envisaged, the opening formed by filling may or must be closed again. This can be effected independently in a further operating procedure by gluing, welding or closing by means of a closure. Yet, these processes may also be incorporated in the device and integrated in the process in terms of control engineering.

The type and configuration of the device according to the invention as well as the course of procedure according to the

invention are definitely suitable to be integrated in a simple appliance operable by hand so as to provide a user-friendly and mobile apparatus for the flexible filling of foil bags or for separating foil layers.

Furthermore, the helical hollow cylinder can be devised in a manner that several openings are provided within the pitches. In this context it is proposed that at least one opening opens in the vicinity of the cutting surface or along the thread being in communication with the interior of the cylindrical hollow body. It is, thus, feasible to separate several foil layers from one another in one operating procedure and, at the same time, to fill a medium in between the layers. If theses bores are differently free, or closed, by a tube running in the interior of the hollow cylinder, also different filling levels or filling media can be introduced in the individual layers. The simple filling of two-layer foil bags is, thus, as readily feasible as the rinsing, separation and ventilation of multi-layer flat foils connected by adhesion or material bonding, aimed to ensure optimized further processing of such foil blanks. In this context it is preferably proposed that the device according to the invention comprises an internally arranged, second, unilaterally closed hollow cylinder, wherein said second hollow cylinder determines the exit opening for the gaseous or liquid medium between the separated foil layers by changes in position.

In the following, the invention will be explained in more detail by way of exemplary embodiments with reference to the drawing. In the drawing:

Fig. 1 depicts an assembled device according to the invention for separating two-layer foils for realization of the method according to the invention;

Fig. 2 illustrates the helically designed, cylindrical hollow body of the device according to the invention; and

Fig. 3 illustrates the helically designed, cylindrical hollow body rotated into two foil layers.

In Fig. 1 it is shown how a helically designed, cylindrical hollow body 3 of a device for penetrating or pricking foil-like substrates is rotationally mounted in a housing 7 and driven by a motor 1 via a flexible coupling 2. Vacuum can be generated by means of the funnel 4 via the duct 5 so as to position and fix foil layers 8 on the cutting surfaces 9 of the helically designed, cylindrical hollow body 3. After separation of the foil layers by the rotating helically designed, cylindrical hollow body 3, a medium can be introduced between the foil layers 8 through a duct 6 and via the bore 10.

In Fig. 2 there is shown the helically designed, cylindrical hollow body 3, which may be coupled to a drive by means of the shaft end 15 and, on the other hand, comprises a helically designed end 12 terminating in the cutting surfaces 14. Gaseous or liquid media can be introduced through the bore 13 including the inlet opening 11.

In Fig. 3 there is shown how the helically designed, cylindrical hollow body 3 is rotated into a bag comprised of two foil layers 17 and 18, so that the upper foil layer 18 is lifted by the helically designed pitch 16 and separated from the second foil layer 17.